

The rocks which have brought Christmas Island into the most prominent notice are the thick beds of nearly pure lime phosphate capping several of the higher hills. It is inferred that this deposit has been formed by the action of beds of guano on limestone forming the summits of the low islets presumed to have existed previous to the first elevation of the present island. Another phosphatic bed is considered to have been produced by guano acting on volcanic ash. It is for the purpose of working these phosphates that the island has been leased by a commercial company.

Although the greater part of the volume is of a highly technical nature, it must not be inferred that this is the case with the whole of its contents. As an example of its lighter side, the excellent account of the habits of the Frigate-bird may be cited. These birds, which form the main support of the present colony of the island, are of an inquiring and fearless disposition.

"The usual way of obtaining them is," writes the author, "for a man to climb into the topmost branches of a high tree near the coast, armed with a pole eight or ten feet long and a red handkerchief. The latter he waves about, at the same time yelling as loudly as possible. The birds, attracted by the noise and the red colour, swoop round in large numbers, when they are knocked down with the long pole. In this way sufficient birds to supply the small colony with food can usually be obtained in an hour or two; occasionally, however, in unfavourable states of the wind, they are difficult to procure."

From first to last, the exploring, the collecting, and the descriptive and literary portions of the book have been thoroughly well carried out. And, despite the fact that no far-reaching or epoch-making discoveries in either zoology, geology, or distribution have been made, all concerned in the production of the volume before us (save the printer) are to be heartily congratulated on the manner in which they have executed their respective tasks.

R. L.

#### A NEW WORK ON SILVER.

*Metallurgy of Lead and Silver.* Part ii. Silver. By Henry F. Collins. Pp. 352. (London: Griffin and Co., Ltd., 1900.)

WE recently had occasion to notice the first volume of the present work, and to speak favourably of its merits. We are pleased to find the second portion equally good. It has been a source of great regret that the distinguished master of metallurgy, the late Dr. Percy, did not live to complete his projected work on Silver, instead of leaving what has been termed a splendid fragment: and as no book claiming to give a full account of the metallurgy of the subject has been published since, we cordially welcome the advent of a further contribution. It is perhaps unnecessary to point out how closely interwoven is the metallurgy of lead with that of silver, or to state that a full treatise on silver cannot be written without considerable reference to lead; and when one author is competent to deal with both branches of the subject, it affords the best means of imparting a sound knowledge of these metals. In the present case we have this additional advantage, that the editor is an

authority on all questions relating to the nature and properties of silver, together with that of assaying. The immense importance of silver in the economic relations of the United States is well known, and many attempts have been made to introduce similar relations into this and other countries; hence it may be considered one of the most important metals known to mankind. The present work is not an exhaustive treatise on silver, and is evidently intended chiefly for those who are connected with the extraction of the metal from its ores. Those ancient methods which are fast becoming obsolete have not escaped notice; for, while they may not possess much practical value at the present time, their chemical and educational value is not to be despised. Numerous references to original sources of information are given throughout the volume, and this will enable the reader to obtain fuller information than is given here. The method of procedure in special works, such as that of matte smelting at Sunny Corner (p. 268), is described at some length with clearness and precision. The author has followed the same plan as in his first volume, of economising space by giving details of the practice at different localities in the form of tabular statements. This should prove useful for reference and comparison. The book is divided into four main sections, dealing respectively with silver and its ores, amalgamation, lixiviation, and smelting processes. Of these the chapters relating to lixiviation and blast furnace smelting are the best, as they appear to be the branches with which the author is most familiar. The hyposulphite leaching process is described in a more lucid and methodical manner than we have seen elsewhere, and the advantages and disadvantages of calcium sulphide are admirably compared on p. 197. A chapter is specially devoted to hyposulphite leaching practice, in which is given details of plant, mode of working, advantages and disadvantages of lixiviation, cost, and examples of the Russell process in various localities. Data as to cost and results at mills using the Patera and Russell processes respectively are given in the form of tables on pp. 224 to 227. A serviceable chapter on the refining of lixiviation sulphides concludes the section. The fourth section, dealing with the extraction of silver by smelting processes, contains a considerable amount of information in a condensed form. The table of comparison of various systems of smelting is instructive and helpful. The construction of furnaces is made clear by the aid of figures, drawn to scale. The arguments in favour of the hot blast for smelting mattes are pertinent and convincing. Several well-compiled tables are included in this chapter. Pyritic smelting receives only a brief notice in Chapter xv., as this subject has been partly dealt with in the first volume. The subject of matte smelting in reverberatories for silver-copper ores is next considered, and the characteristics of the method, with the points of difference from blast furnace practice, are pointed out. This kind of information is often of great moment to the practical man, who has to decide on the most economic method to adopt in special cases. The final chapters deal with the treatment of argentiferous mattes, which generally require a preliminary concentration to eliminate some of the lead and iron. In some cases a direct method may be

adopted, and information is here given for that purpose. The Bessemerising of copper mattes is briefly described. Silver-copper smelting and refining is limited in its application to ores comparatively free from sulphur, arsenic, and lead, and therefore but little used. The plant employed is specified and illustrated by diagrams and tables. The book concludes with a short account of the various wet methods used for argentiferous slimes. The author's attempt to cover the ground embraced by such a wide subject within a moderate compass will, with the aid of tables and summaries, prove most valuable both to practical men and to students.

#### OUR BOOK SHELF.

*The History of Language.* By Henry Sweet, M.A. Pp. xi + 148. (London: J. M. Dent and Co., 1900.)

THERE are few living scholars who are so well qualified as Dr. Sweet to write a thoroughly comprehensive introduction to the science of language. He is, as is well known, one of the foremost European authorities on phonetics; but at the same time he is a profound and original thinker on those psychological aspects of linguistic science in which few phoneticians take any interest. And while possessing a competent knowledge of Indogermanic comparative philology in its latest developments, he is preserved from the narrowness of view of the mere Indogermanist by having made a practical study of Arabic, Finnish and Chinese. Notwithstanding its small size, this "primer" is a very remarkable book. In completeness of outline, it is superior to any elementary manual of the subject known to us; and it is no mere arid skeleton, but contains a good deal of novel and interesting illustration of the principles expounded. Perhaps it is not quite so easy to master as a "primer" is usually expected to be. Although strictly elementary, in the sense that it assumes no previous philological knowledge on the reader's part, it does undoubtedly demand considerable power of close attention and some training in habits of scientific thought. It will therefore probably be less acceptable to absolute beginners than to those who have already some general knowledge of the subject and desire to render their conceptions of it more systematic and precise. Even by advanced philological scholars it may be studied with interest and profit.

The contents of the book may be said to consist of three portions: an exposition of the general principles affecting the development of language, an outline of the history of the Aryan family of languages, and a statement of the author's views as to the exterior affinities of Aryan and the locality in which it was developed. Perhaps the third part is somewhat out of place in an elementary book, but it is at any rate interesting. Dr. Sweet's hypothesis is that primitive Aryan arose in Scandinavia out of a mixture of the language of Ugrian conquerors with that of the aboriginal population among whom they were absorbed. This is not now such a startling heresy as it would have been a few years ago, though it is not likely at present to find a ready welcome from Indogermanists. The apparent affinities between Aryan and Ugrian certainly seem too striking to be due to mere coincidence, but it is a long step from this admission to the acceptance of the definite theory here propounded. The writers who have hitherto advocated somewhat similar views have always discredited their case by their ignorance of philology and their lack of scientific caution. It is to be hoped that Dr. Sweet will give to the world a full exposition of the grounds on which his conclusions are based. Whether he succeeds

in the establishment of his particular thesis or not, he can hardly fail to make a valuable contribution towards the ultimate solution of the question.

*Micro-organisms and Fermentation.* By Alfred Jörgensen. Pp. xiii + 318. (London: Macmillan and Co., Ltd., 1900.)

THE study of the biology of fermentation has made considerable progress in recent years. The knowledge that has been gained of the nature and mode of action of the living agents in question is mainly due to the efforts of foreign observers. Through the investigations of Pasteur, and most notably of Hansen, the subject became a recognised branch of methodical and practical inquiry. To be in a position to employ the essential and to exclude the deleterious agents in a fermentative process is to substitute scientific for haphazard methods. This, briefly put, is the aim of technical mycology, and the gain to a given industry is considerable, as *e.g.* in brewing and distilling operations. Of the books dealing with micro-organisms and fermentation, Dr. Jörgensen's has long occupied a leading position, and hardly requires an introduction to the specialist. The new edition just issued has been completely revised, and the English translation has been well done by Dr. A. K. Miller and Mr. A. E. Lennholm. Dr. Jörgensen's reputation as a teacher and investigator, as well as his intimate association with Hansen, place this work above the ordinary run of text-books. The first chapters deal with the methods of microscopical and physiological examination of micro-organisms, and the methods for obtaining and utilising pure cultures of the useful races of *saccharomyces* are described. The examination of water and air is next dealt with—a subject of importance on account of the injurious organisms that may exist in the air and water of a brewery. The chapter on bacteria is somewhat incomplete. The technical mycologist has commenced to study the bacteria more closely, and a fuller account of this branch of the subject will be found in Lafar's book. An interesting account is given of the alcohol-forming bacteria, and of certain symbiotic ferments, *e.g.* Kephir and the ginger-beer plant. The moulds of importance in technical work are fully dealt with.

Of recent work, Buchner's "Zymase" is shortly alluded to; but more mention might have been made of Calmette's investigations at Lille and Sèclin upon the symbiotic action of moulds and yeasts in the alcoholic fermentation. The account of the alcoholic ferments in Chapter v. is naturally the main and distinctive feature of this work, and it will be particularly valuable to the English reader on account of the lucid description it contains of Hansen's investigations upon yeasts. The various species of bottom and top fermentation yeasts of interest to the brewing chemist are fully dealt with. The final chapter is devoted to the application of the results of scientific research in practice. The value of the book is added to by a number of illustrations and a very full bibliography. As an introduction to the morphology and biology of the alcoholic ferments, Dr. Jörgensen's work leaves little to be desired, and constitutes a valuable complement to the text-books which deal mainly with the chemical side of the subject.

A. M.

*Photography in Colours.* By R. C. Bayley. Pp. 74. (London: Iliffe, Sons and Sturme, Ltd., 1900.)

THIS little book is practically a reprint of a series of articles by the author which have already appeared in a photographic periodical, but the subsequent revisions and convenience of reference occasioned by their collection under one cover should render them more serviceable. The general principle has been to avoid technicalities and purely executive details, aiming rather to